The SMART Road to Accreditation: Lessons from the Front

Michelle Kilikauskas
Joint Accreditation Support Activity
Naval Air Warfare Center, Weapons Division
China Lake, CA USA
email: michelle_kilikauskas@imdgw.chinalake.navy.mil

Approved for Unlimited Distribution

Summary For the past six years the Joint Accreditation Support Activity (JASA) and its predecessor, the Susceptibility Model Assessment and Range Test (SMART) project, have provided model and simulation accreditation support to US Department of Defense (DoD) acquisition programs. This paper summarizes keys to cost effective, meaningful accreditation derived from experience working with missile, aircraft, and electronic warfare systems programs in various stages of the systems acquisition cycle.

1. INTRODUCTION

The Susceptibility Model Assessment and Range Test (SMART) project was established in 1992 by the Office of the Undersecretary of Defense for Acquisition and Technology with three goals: to develop cost effective model and simulation (M&S) verification, validation and accreditation (VV&A) methodology, to demonstrate that methodology on five legacy survivability models, and to transition the methodology and the lessons learned to the larger acquisition community. As a follow-on to SMART, the Joint Accreditation Support Activity (JASA) was instituted in 1996 to assist acquisition programs with the planning and implementation of V&V and model assessment tasks which support accreditation.

Several trends within DoD made the SMART project and JASA's services timely. The overall drawdown in defense spending has resulted in a reduction in funding available for model development and for verification and validation. The funding drop has also spurred interest in the use of M&S to replace or supplement more expensive system design, test and evaluation, and training methods. In fact, the 5000 series of directives regarding the acquisition of defense systems requires the use of accredited models and simulations throughout the acquisition cycle from requirements definition to post-deployment support.

As the pressure to use modeling and simulation has increased, so also has the burden on program managers to defend the credibility of analysis based upon the results of those models. As used in the 5000 series of directives, accreditation is a decision that a model or simulation is adequate for a particular purpose; accreditation decision authority generally rests with the person responsible for the use of the model output. The staff of the SMART project and now the Joint Accreditation Support Activity has worked closely with systems acquisition programs endeavoring to comply with the 5000 directives. This paper summarizes the major lessons learned through SMART and JASA's experience designing and implementing cost effective M&S VV&A programs to support accreditation.

2. BASIC PRINCIPLES

First, keep in mind that accreditation is a decision. The responsibility of the accreditation support agent is to provide the accreditation authority with sufficient information to make an intelligent and defensible decision about whether or not a model or simulation is appropriate for their needs. The amount of information necessary to defend an accreditation decision (and therefore the amount of resources required to generate that information) is dependent upon several factors, including the importance of the decisions to which the model contributes, the ramifications of a wrong decision based upon model results which are not credible, and the dollar amount of the program. Because accreditation of M&S is but one of myriad concerns, program managers are motivated to spend only as much as is necessary to establish an acceptable level of confidence in model results. The question often becomes " How confident can I afford to be?" The accreditation support agent has a responsibility to help the decision authority to invest his limited accreditation support resources on those tasks which contribute the most to credibility for the least cost.

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE **1996**	2. REPORT TYPE	3. DATES COVERED **00-00-1996 to 00-00-1996**

4. TITLE AND SUBTITLE **The SMART Road to Accreditation: Lessons from the Front**		5a. CONTRACT NUMBER
		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)		5d. PROJECT NUMBER
		5e. TASK NUMBER
		5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Joint Accreditation Support Activity ,Naval Air Warfare Center,Weapons Division,China Lake,CA**		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**4**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

A corollary to the first principle is that accreditation is both a technical and a political decision. Insight into the proponents and detractors of the model and the influence they exert is crucial. As DoD increases the pressure to reduce the number of models in use, the selection of a particular model by high visibility acquisition programs will become even more politically charged. A well thought-out and well articulated rationale for selecting and accrediting a particular model over its competitors is critical for defending the decision to the Defense Acquisition Board (DAB), which approves transition from one phase of the acquisition process to another, and to Congress who ultimately controls the funding. From this point of view, accreditation support is a form of risk reduction and mitigation.

The second idea to keep in mind is that complying with directives such as the 5000 series in the US is a secondary goal. The primary goal of accreditation is to understand the strengths and weaknesses of the model under consideration and their effects on the credibility of analysis based on model output. While a program manager's initial interest in VV&A may be driven by the need to comply with directives, the long term goal of the program is to make decisions which are well grounded and to produce a quality product. The accreditation support agent can be helpful in providing this perspective. Since VV&A must be addressed to check the box anyway, let's make it meaningful.

If insight into the credibility of M&S output is the goal of meaningful accreditation, a clear statement of the intended use of the M&S under consideration is the foundation. The better the intended use is defined, the more focused (and cost effective) the V&V and model assessment efforts can become. In the tailored VV&A process developed by SMART, the first step is to understand how the client envisions using the M&S. What analysis questions are being addressed? What measures of merit will be used to quantify answers to those questions? What level of fidelity is required in the answers? What assumptions underlie the analysis?

Once those issues are clarified, model acceptance criteria can be developed based upon the intended use. The SMART process identifies three types of criteria: functional, fidelity, and operational. What functions must the model perform in order to address the questions of interest? To what level of detail must these functions be modeled, and what level of accuracy is required in model output to meet the decision maker's needs? In what kind of environment must the M&S run: computer platform and/or operating system, real time vs. non- real time, level of experience or training of model operators,

compatibility with other analysis efforts, etc. The acceptance criteria derived from the answers to these questions form a standard against which the model of interest is assessed for accreditation, and V&V efforts are focused on those features of the M&S and those portions of the code which are related to those criteria. The more the problem of interest can be defined, the less effort is wasted on examining features of the model which are not relevant.

3. LESSONS LEARNED

While clear definition of analysis goals and M&S implementation strategy is a key to cost effective accreditation, our observation has been that most acquisition programs begin with only a loose understanding of how analysis and M&S will be used. Transforming a general idea of the types of issues that need addressing and a vague notion of how M&S might play into a carefully constructed and well articulated plan is a long and painful process. The programs to which SMART/JASA have been the most help are ones in which the accreditation support personnel got involved with the analysis team early and stayed involved over time. This gives the accreditation support team the opportunity to listen carefully to the analysis team to make sure they understand the client's analysis goals (as well as the simplifying assumptions), and to keep up as the analysis plans naturally evolve. The greater the insight into the analysis effort, the more focused the accreditation assessment efforts. Additionally, the accreditation support team's knowledge of the models and analysis areas of interest often prove useful in identifying potential risk areas early enough to allow time to mitigate or avoid the problem. Mitigation might involve making model improvements, gathering more credible input data, or using different tools in areas where the tool of choice is weak. The lesson here is to get involved early and stay involved.

Another basic lesson is that accreditation is an iterative process. As circumstances change over time, the accreditation issue must be revisited. Analysis questions and/or assumptions change from one phase of a program to another, model code and input data sets change on a periodic basis, and the importance of M&S in the resolution of analysis issues shifts from phase to phase. Careful documentation of previous accreditation assessments and disciplined configuration management of model code and input data sets on the part of both the model manager and the program office analysis staff minimizes the amount of effort required for a reassessment. Consistent involvement of the accreditation support personnel and the analysis team

also minimizes the learning curve for each successive round of accreditation.

The accreditation support staff can also make a substantial contribution to the programs it supports by participating in the process by which they decide whether and how to invest program funds in model and data improvement. Because program managers are generally not modeling or analysis experts themselves, they are vulnerable to persuasive pleas for funding for model improvements which may be worthy, but are not high priority *given the analysis needs of the program.* The larger and more visible the program, the more appealing a target it is for model managers and model users interested in model improvements. The accreditation staff can be of help by consistently asking how a proposed model improvement effort is related to the analysis needs of that program in the near to mid term.

Many forces converge to cause program office personnel to have a short term focus. In the US, program office personnel are generally military, and they rotate assignments every two to three years. They are evaluated on a yearly cycle, and they are barraged with issues which are pressing today. Accreditation support agents can play a valuable role by taking a longer term, more balanced view. Keeping one eye on the long term brings two benefits: first, it allows one to consider how to make the effort currently being expended of most use in the future, and it encourages one to look ahead to the impact of current modeling limitations on later phases of analysis in time to implement model changes or select and develop proficiency with other tools. Limitations which may be of little importance to the questions of interest today may be show stoppers for questions in the next phase. The other eye needs to be firmly fixed on how the skills and knowledge base of the accreditation support personnel can be most helpful in the here and now. What of value can we do to meet today's needs with the resources the client has available now?

Program managers generally do not have a modeling or simulation background, and accreditation is not generally on the top of their priority list. There are many benefits to having a central, independent activity like JASA which keeps current on policy statements and the way in which that policy is being implemented (both of which are in great flux in the US), has experience in conducting verification, validation and accreditation, has access to expertise in various modeling areas, has active contract vehicles available for performing VV&A related tasks, and maintains a repository of VV&A documentation. The availability of expert help increases the probability that programs will comply with VV&A policy and that

their efforts will be meaningful. Knowledge of what's already been done (and documented!) reduces duplication of effort and maximizes the usefulness of the V&V work funded by individual programs or agencies to the larger analysis community. The availability of experienced personnel also reduces the cost to individual programs of designing and implementing a VV&A program. As noted earlier, the usefulness of an accreditation support agent to an acquisition program is also dependent upon the willingness to listen and learn about the particular needs of each client.

The quality and appropriateness of the model code itself is only half of the problem. Quality of model input data, its appropriateness to the model, and tracability to authoritative sources is the other half. Data quality and pedigree is a verification, validation, and certification (VV&C) issue. Regardless of the quality of the model code, bad input leads to bad output. Increasing emphasis within DoD on use of officially designated authoritative sources, in concert with the acknowledged shortfalls in some areas of interest create a great challenge for acquisition programs. Although official guidance on VV&C of data is currently less well defined than that on VV&A of model code, data quality and pedigree and the influence on the credibility of model output must be addressed as part of an overall accreditation effort.

Finally, some very practical observations. First, model usage and V&V history and a summary of assumptions, limitations, and errors are useful to a broad base of model users and they are two of the least expensive V&V activities. Usage and VV&A history can help build a case for provisional or preliminary accreditation based upon community acceptance, and the assumptions and limitations can help a potential user to quickly decide whether a model deserves consideration for a particular problem. Before SMART, these topics were generally not addressed in standard model documentation sets. Second, thick skin is a definite asset for individuals involved with accreditation support. The honest broker is often not everyone's favorite individual.

4. CONCLUSION

The contribution of a competent and proactive accreditation support team can extend far beyond providing V&V underpinnings for meaningful accreditation statements. Experience by the SMART/JASA team suggests several keys for helping accreditation support personnel make the most of their efforts. Get involved early in the program and stay involved. Listen and learn. Keep one eye on the short term and the other on the big picture. Be proactive in

contributing to other aspects of the program such as data and model improvement investment plans and configuration management efforts. Be flexible. Play the role of an honest broker even though this is often uncomfortable. Have a thick skin. Above all, help the customer become as confident in M&S results as he or she needs to be, within the confines of the time and money available.

Visit the Joint Accreditation Support Activity at our web site: http://www.nawcwpns.navy.mil/~jasa